

CLAIMS

1. A method for irradiating a target, comprising the steps of:
 - establishing a relationship of at least one marker relative to the target;
 - generating an image signal of the least one marker;
 - generating a tracking signal in response to the image signal; and
 - adjusting a radiation beam in response to the tracking signal to track the target.
2. The method as claimed in claim 1, wherein:
 - the step of establishing a relationship of at least one marker relative to the target includes implanting the at least one marker in a patient undergoing a radiation treatment for a tumor;
 - the step of generating an image signal includes generating an X-ray image of the at least one marker; and
 - the step of generating a tracking signal includes generating the tracking signal to track a movement of the tumor.

- 1 3. The method as claimed in claim 1, wherein the step of
2 generating an image signal includes generating the image
3 signal regarding an anatomy of a patient having a tumor
4 as the target.
- 1 4. The method as claimed in claim 1, wherein the step of
2 generating an image signal further includes the steps of:
3 illuminating the target and an area near the target with
4 a first image beam; and
5 detecting a first image of the at least one marker formed
6 by the first image beam.
- 1 5. The method as claimed in claim 4, wherein the step of
2 generating an image signal further includes the steps of:
3 illuminating the target and the area near the target with
4 a second image beam unparallel to the first image
5 beam; and
6 detecting a second image of the at least one marker
7 formed by the second image beam.
- 1 6. The method as claimed in claim 1, wherein the step of
2 adjusting a radiation beam further includes the steps of:
3 superimposing the tracking signal on a radiation
4 treatment plan; and
5 generating a beam adjustment signal using the treatment
6 plan with the tracking signal superimposed thereon.

1 7. The method as claimed in claim 1, wherein the step of
2 adjusting a radiation beam further includes adjusting the
3 radiation beam using a first multiple leaf collimator
4 having a plurality of movable leaves arranged in two rows
5 opposite to each other.

1 8. The method as claimed in claim 7, wherein the step of
2 adjusting a radiation beam further includes adjusting the
3 radiation beam using a second multiple leaf collimator
4 having a plurality of movable leaves arranged in two rows
5 opposite to each other and unparallel to the plurality of
6 leaves of the first multiple leaf collimator.

1 9. The method as claimed in claim 7, wherein the step of
2 adjusting a radiation beam further includes temporarily
3 switching off the radiation beam in response to the
4 tracking signal having a value indicating the target
5 being outside an area.

1 10. A method for irradiating a target in an animal body,
2 comprising the steps of:
3 establishing a relationship of at least one marker
4 relative to the target, the at least one marker
5 being placed internally in the animal body;
6 generating an image signal of the least one marker;
7 generating a tracking signal in response to the image
8 signal; and
9 adjusting a radiation beam in response to the tracking
10 signal to track the target.

- 1 11. An apparatus for irradiating a target, comprising:
2 a platform for supporting an object having a marker
3 indicating a position of the target;
4 a radiation source, said radiation source generating a
5 radiation beam toward said platform;
6 a beam adjuster between said radiation source and said
7 platform;
8 a first image detector, said first image detector
9 generating a first image signal of the marker; and
10 a control module coupled to said image detector and to
11 said beam adjuster, said control module generating
12 a beam adjustment signal for said beam adjuster in
13 response to the first image signal.
- 14 12. The apparatus of claim 11, said control module being
15 further coupled to said radiation source and generating a
16 control signal to switching off said radiation source in
17 response to the first image signal.
- 18 13. The apparatus of claim 11, said control module being
19 further coupled to said platform and generating a control
20 signal to move said platform in response to the first
21 image signal.
- 22 14. The apparatus of claim 11, said first image detector
23 including at least one device selected from a group of
24 devices consisting of a video camera, an X-ray imager, a
25 magnetic field detector, an ultrasound sensor, a computed
26 tomography imager, a single photon emission computed
27 tomography imager, a magnetic resonance imager, a
28 magnetic resonance spectroscopy imager, and a positron
29 emission tomography imager.

1 15. The apparatus of claim 11, further comprising a gantry,
2 said gantry housing said radiation source and said beam
3 adjuster.

1 16. The apparatus of claim 15, said control module being
2 further coupled to said gantry and generating a control
3 signal to move said gantry in response to the first image
4 signal.

1 17. The apparatus of claim 11, further comprising a first
2 image beam source generating a first image beam toward
3 said platform, said first image detector generating the
4 first image signal by detecting the first image beam.

1 18. The apparatus of claim 17, further comprising:
2 a second image beam source, said second image beam source
3 generating a second image beam toward said platform
4 and unparallel to the first image beam; and
5 a second image detector coupled to said control module,
6 said second image detector generating a second
7 image signal by detecting the second image beam.

1 19. The apparatus of claim 11, said beam adjuster including a
2 first multiple leaf collimator comprised of a first row
3 of movable leaves and a second row of movable leaves
4 opposite to each other.

1 20. The apparatus of claim 19, said beam adjuster further
2 including a second multiple leaf collimator between said
3 first multiple leaf collimator and said platform and
4 comprised of a plurality of movable leaves unparallel to
5 said first row and said second row of movable leaves in
6 said first multiple leaf collimator.

1 21. A radiation therapy process, comprising the steps of:
2 marking a tumor in a patient with at least one marker;
3 generating a first image signal of the least one marker;
4 generating a tracking signal in response to the first
5 image signal to track a movement of the tumor; and
6 adjusting a first multiple leaf collimator in response to
7 the tracking signal to adjust a radiation beam
8 projected onto the patient.

1 22. The radiation therapy process of claim 21, the step of
2 marking a tumor including implanting the at least one
3 marker into the patient.

1 23. The radiation therapy process of claim 21, the step of
2 generating a first image signal including the steps of:
3 illuminating the tumor and an area near the tumor with a
4 first image beam; and
5 detecting a first image of the at least one marker formed
6 by the first image beam.

1 24. The radiation therapy process of claim 23, further
2 comprising the steps of:
3 illuminating the tumor and the area near the tumor with a
4 second image beam, the second image beam being
5 unparallel to the first image beam;
6 detecting a second image of the at least one marker
7 formed by the second image beam; and
8 generating a second image signal in response to the
9 second image of the at least one marker.

1 25. The radiation therapy process of claim 21, the step of
2 adjusting a radiation beam including the steps of:
3 superimposing the tracking signal on a radiation
4 treatment plan for the tumor; and
5 generating a beam adjustment signal using the radiation
6 treatment plan with the tracking signal
7 superimposed thereon.

1 26. The radiation therapy process of claim 21, further
2 comprising the step of moving a platform supporting the
3 patient to reposition the patient in response to the
4 tracking signal.

1 27. The radiation therapy process of claim 21, further
2 comprising the step of moving a source generating the
3 radiation beam to adjust a projection direction of the
4 radiation beam onto the patient in response to the
5 tracking signal.

1 28. The radiation therapy process of claim 21, further
2 comprising the step of switching off the radiation beam
3 in response to the tracking signal.

1 29. A process for irradiating a target in an animal body,
2 comprising the steps of:
3 collecting a plurality of images at a plurality of phases
4 in a cycle, said plurality of images providing an
5 indication of a location of the target;
6 creating a treatment plan based at least in part on the
7 plurality of images collected at the plurality of
8 phases in the cycle; and
9 delivering a radiation beam to the animal body according
10 to the treatment plan.

11 30. The process of claim 29, the step of collecting a
12 plurality of images of the target including the steps of:
13 implanting at least one marker into the animal body; and
14 collecting a plurality of images of the at least one
15 marker at the plurality of phases in the cycle.